

Analysis of Expected Rating Changes – General Overview February 2009

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This report summarizes expected rating changes due to the application of new models starting on February 23, 2009. A large percent of Portfolio Manager users will be impacted by the following changes:

- Revised Hotel model
- Revised K-12 School model
- Revised Pool methodology
- Corrected eligibility requirements

In addition to these changes, EPA is adding a new Multifamily Housing space type. Although this new space will not affect any existing properties in the tool, it will provide a new opportunity for many users. Details about this change are also provided.

Overview of Rating Changes

Reports were requested to assess the average rating change. Average changes are presented below, and are most meaningful when viewed over the specific impacted populations: schools, hotels, and pools. Data for this analysis was extracted from Portfolio Manager on October 8, 2008. Therefore, the computed values approximate the changes that will occur on February 23, though specific building data may have changed in the last few months.

Hotels

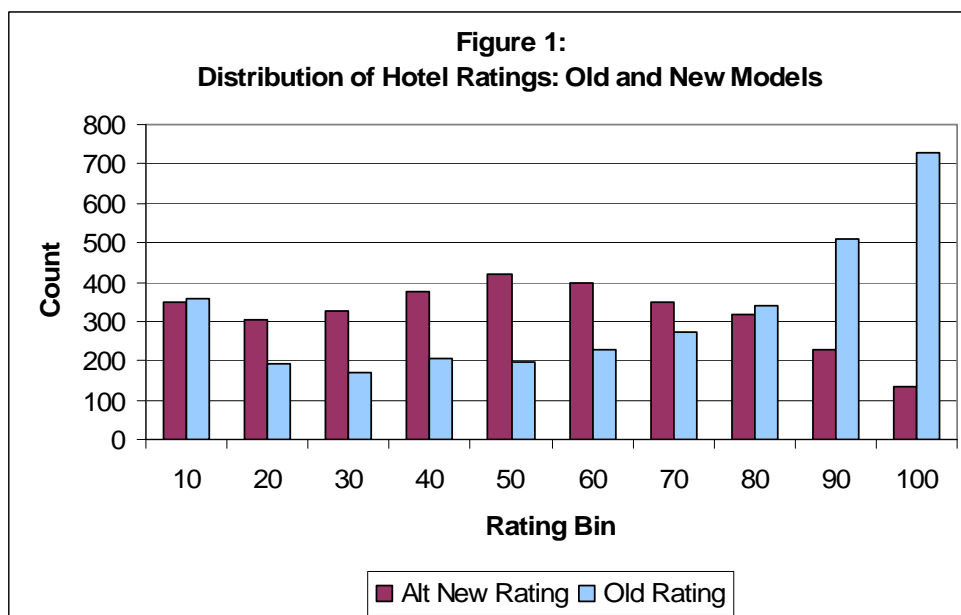
The initial report provided by SRA included 3,358 buildings. A basic set of filters was established by EPA to remove extreme/questionable data from the analysis. A complete list of filters is provided in **Attachment A**. After the filters, a total of 3,203 buildings were analyzed.

- The average change across all 3,203 hotels is -15 points
 - 77% experience a decrease, with an average of -24 points
 - 20% experience an increase, with an average of +18 points
 - 3% experience no change
- Average changes at hotels differ for each hotel amenity category, and are also heavily influenced by a few organizations who own a large percentage of the total number of hotels. Hotel score changes by amenity category are summarized in the **Table 1**.
 - Economy Hotels represent 27% of the hotel properties.
 - Average old rating: 81
 - Average new rating: 48
 - Other hotel categories experience more moderate changes.
- In general the new ratings provide a more equitable distribution among hotel amenity categories, with similar averages and distributions for each. This behavior represents an

improvement over the older methodology, which seemed to generate very different performance for each category.

- **Figure 1** presents the distribution of old and new ratings for the hotel population.
 - Old ratings were highly skewed, with a huge percent rating 90 to 100.
 - The new distribution is more equitable: relatively normal, peaking around 50.
 - The average decrease observed in hotel ratings is appropriate.
- A specific report analyzing key hospitality partners will be provided to the commercial sector team.

Table 1			
Hotel Score Changes by Amenity Category			
Amenity Category	Number of Buildings	Percent of Total	Average Change
Hotel (Economy and Budget)	852	27%	-33
Hotel (Midscale w/Food and Beverage)	474	15%	-6
Hotel (Midscale w/o Food and Beverage)	131	4%	-7
Hotel (Upper Upscale)	869	27%	-5
Hotel (Upscale)	877	27%	-12
Grand Total	3203	100%	-15

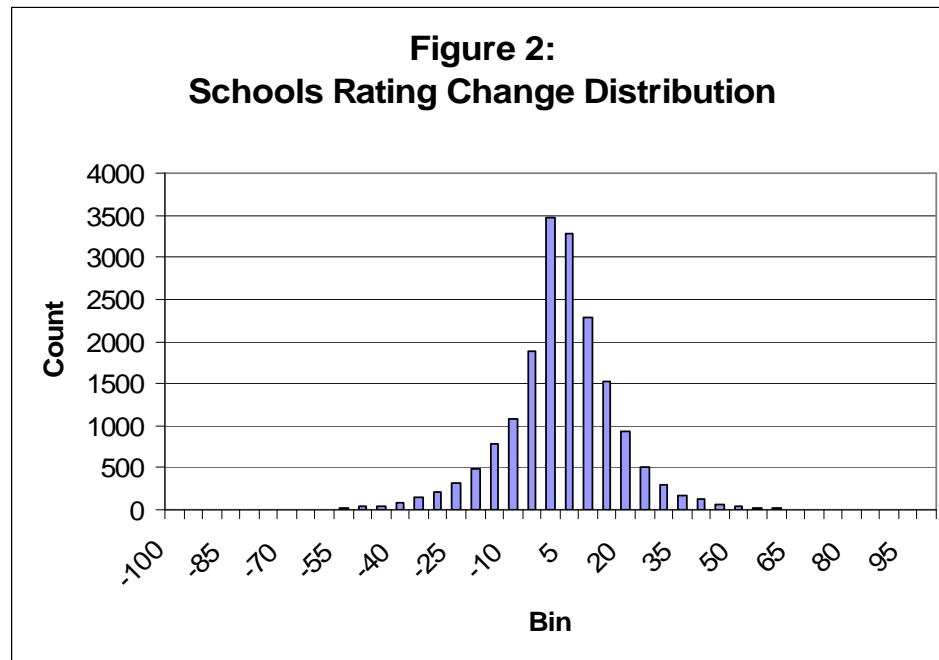


Schools

The initial report provided by SRA included 18,738 K-12 Schools. A basic set of filters was established by EPA to remove extreme/questionable data from the analysis. A complete list of filters is provided in **Attachment A**. After the filters, a total of 17,907 schools were analyzed.

- The average rating change across all 17,907 schools is +1 point, with 52% of the population experiencing an increase and 48% experiencing a decrease.

- **Figure 2** presents the distribution of rating changes for K-12 Schools. This is a relatively tight distribution, centered on the +1 increase.
 - Over 20% of the buildings change within +/- 2 points
 - Over 60% of the buildings change within +/- 10 points
 - Over 90% of the buildings change within +/- 25 points
- A specific report analyzing key K-12 partners will be provided to the public sector team.



Pools

At the time of the data pull, there were only 45 buildings in Portfolio Manager that included a pool but did not include a school or hotel (i.e. not covered by the previous two sections).

- Buildings with pools will see a decrease in rating.
 - All 45 of these buildings experience a decrease, with the average being -6 points.
- The decrease in rating is expected, as the old model was determined to have provided too generous of an allowance.
- The new average rating for these buildings is 52.
- Note that hotels and schools with pools will **not** necessarily experience the decrease in ratings because they will also be impacted by the hotel and school changes.

Eligibility

Due to the application of new eligibility rules, some buildings will no longer be able to receive ratings (refer to Technical Details section)

- 50% rule – Buildings that are not **more than** 50% occupied by a single ratable space type will see NA.
 - There are approximately 72 buildings

- Space attribute rule – defaults values will be assigned so that buildings failing this new rule will still see ratings (refer to Technical Details Section).

Label Information

When ratings change, there is always the possibility that the label eligibility status of certain buildings may change.

Hotels

At the time when the data was pulled (October 8, 2008), 337 of the hotels in the analysis had earned the label, 236 of them in 2007 or 2008.

- Recent winners – Out of the 236 that have earned a label in 2007 or 2008:
 - 104 will continue to have ratings of 75 or higher
 - 15 currently have ratings below 75 and will still have ratings below 75 after the changes.
 - 117 currently have ratings of 75 or higher but will drop below 75 due to the model changes: ***these buildings are no longer eligible to earn a label***
- General eligibility
 - 545 of the hotels in the analysis have ratings of 75 or higher – ***in other words, 17% of the hotels in PM are eligible for the ENERGY STAR***
 - This percent is lower than expected, but preferred to the old distribution where the majority of economy hotels qualified.

Schools

At the time when the data was pulled (October 8, 2008), 1,116 of the schools in the analysis had earned the label, 618 of them in 2007 or 2008.

- Recent winners – Out of the 618 schools that earned the label in 2007 or 2008:
 - 485 will continue to have ratings of 75 or higher
 - 41 currently have ratings below 75 and will still have ratings below 75 after the changes.
 - 92 currently have ratings of 75 or higher but will drop below 75 due to the model changes: ***these buildings are no longer eligible to earn a label.***
- General eligibility
 - 5,297 of the schools in the analysis have ratings of 75 or higher – ***in other words 30% of the schools in PM are eligible for the ENERGY STAR.***

Pools

There are no buildings with pools (excluding Hotels and Schools) that have labels in 2007 or 2008, current ratings of 75 or higher, and new ratings below 75. Hence, the pool changes alone should not affect any label eligibility status.

Eligibility

Buildings that are losing ratings will no longer be eligible for the label.

- 50% Rule – There are three previously labeled buildings losing their rating due to this rule. They will no longer be able to earn the label.
- Space attribute rule – there are many previously labeled buildings that fail this new eligibility requirement. These buildings will have default values entered for them. When the users supply real data, they should be able to apply for the label.

Technical Details

There are five main changes that will occur on February 23. A description of each is provided along with the expected impact to ratings.

1. Revised Hotel Model

Change: The new Hotel model has been updated with more recent market data. Basic characteristics are as follows:

- **Data:** The new model is based on CBECS 2003 data, representing a new reference data source and more recent market data. The old model was based on the 1999 Hospitality Research Group Study.
- **Unit of Analysis:** The new model is based on Source EUI rather than LN(Source Energy). Source EUI is equally robust and easier to explain.
- **New Operating Characteristics:** The new model has added five explanatory variables to enhance model performance across a variety of hotel types.
 - Number of Workers: The number of workers is an important indicator of the level of services provided by the hotel.
 - Presence of Cooking (yes/no): The presence of cooking facilities is a key distinguishing factor for hotels. It is important to have a model that captures the difference between hotels that do not offer food service and hotels that do.
 - Number of Commercial Refrigeration Units: The number of commercial refrigeration units helps to scale the adjustment for the presence of cooking facilities. The presence of these units is likely related to more guest services (for example more banquet space or small shops for guests to buy snacks and beverages, etc). Please note that this variable includes walk-in refrigeration and open and closed refrigeration cases.
 - Percent Heated and Percent Cooled: These variables have been added because they help adjust impact of HDD and CDD to account for the degree of space conditioning.
- **Removed Operating Characteristics**
 - Hotel Amenity Category: the old model outlined five distinct amenity categories, ranging from economy to upper upscale. The distinctions among these categories are not present in CBECS and were not determined to be meaningful within Portfolio Manager. Hence, these categories are no longer part of the model.
- **Statistical Measures:** Overall, the statistical properties of the new model are superior to the old (higher levels of significance, higher effective R^2 value, etc).

Impact to Ratings:

Overall, the average hotel rating drops by approximately 15 points. However, this average is somewhat skewed by a few key partners who own a very high percentage of the buildings. In addition, the drop depends on the current hotel amenity spaces categories. When a new model is created, new estimates are derived for the specific relationship between each operating characteristic and energy. As such, rating changes can be correlated with certain operational characteristics. ***These correlations do not indicate a bias in either the new or the old model; the various relationships are just different.***

- **Size:** The new regression formulation (EUI format) allows for a much more accurate assessment of the relationship between rooms, size, and energy consumption. Under the old model, the smallest buildings (economy) tended to receive an unfair bonus, thus resulting in unusually high ratings. The new model corrects this bias. Hence small buildings are more likely to see large rating decreases while large buildings will see small decreases or increases in rating.
- **Room Density:** Based on the improved adjustments for size and room density, buildings with higher room density will tend to see larger decreases. This is closely related to the trend for size (above).
- **Amenity Category:** The previous two trends in changes to size and room density are strongly correlated with amenity category. Economy hotels tend to be small hotels with high room density – they are experiencing the largest rating decreases. Upscale hotels are larger with lower room density – they are experiencing smaller decreases (or increases).
- **Cook** – There is no strong relationship between the presence of cooking and the change in rating.
- **Workers** – Because the number of workers is not currently collected and all hotels will receive a default value, there is no way to assess the correlation between workers and the change in rating.

2. Revised K-12 School Model

Change: The new K-12 School model has been updated with more recent market data. Basic changes are as follows:

- **Data:** The new model is based on CBECS 2003 data, while the old model was based on CBECS 1999 data. More recent data provides a more accurate description of the current market conditions.
- **Unit of Analysis:** The new model is based on Source EUI rather than LN(Source Energy). Source EUI is equally robust and easier to explain.
- **New Operating Characteristics:** The new model has added three explanatory variables:
 - High School (yes/no): This variable accounts for significant differences observed in the energy behavior of high schools as compared with other schools.
 - Weekend Operation (yes/no): This variable allows for a more equitable adjustment than hours of operation. The hypothesis is that this better captures the start-up/shutdown energy associated with weekend operation.
 - Number of Walk-in Refrigeration Units: This variable allows for a superior assessment of the level of cooking activity and required refrigeration.

- **Removed Operating Characteristics:** The new model no longer contains some variables which were found to be insignificant. Analysis of both CBECS and Portfolio Manager data confirms that there is *not a meaningful, statistically significant relationship* between these characteristics and energy consumption at K-12 Schools.
 - Mechanical Ventilation (yes/no)
 - Student Seating Capacity
 - 12 Month Operation (yes/no)
 - Weekly Hours of Operation
- **Statistical Measures:** Overall, the statistical properties of the new model are superior to the old (higher levels of significance, higher effective R² value, etc).

Impact to Ratings: Overall, the average change for K-12 Schools is only +1 point. As discussed above, the changes are close to normally distributed around 0, with few extreme values. When a new model is created, new estimates are derived for the specific relationship between each operating characteristic and energy. As such, rating changes can be correlated with certain operational characteristics. *These correlations do not indicate a bias in either the new or the old model; the various relationships are just different.*

- **High School (yes/no):** High Schools were identified in Portfolio Manager through the presence of “High School” or “HS” in the building name. Analysis shows that these buildings were rating lower than other schools in the old model. The new model adjustments correct this bias. Hence, High Schools are more likely to see rating increases.
- **Building Size** – The new regression formulation (EUI format) shows that while larger schools use more energy, they use less energy per square foot. This effect is an economy of scale. The new model is able to correct for this trend where the old could not. As such, larger buildings are more likely to see rating decreases.
- **Climate (HDD and CDD):** The new regression estimates for HDD and CDD result in greater decreases when the HDD values are above average and the CDD values are below average (i.e. colder climates, with HDD around 6,000). In general, more extreme climates are sensitive to model changes. If a model coefficient changes by 10%, this will have a larger net impact at the extreme. Note that extremely warm climates (i.e. very high CDD with low HDD) would be expected to decrease, too. However, there are fewer of these in Portfolio manager.
- **Computer Density:** Due to the change in PC adjustments, buildings with very high PC density may be more likely to experience an increase in rating, while buildings with very low PC density may see a decrease.
- **Open Weekends:** Buildings with 100 or more hours of operation were set to “yes” for this variable. These buildings are more likely to see an increase because the old model did not count for the added energy requirement of weekend operation.
- **Cook (yes/no) and Walk-in:** Buildings currently reporting “no” for cooking are assigned a default of zero walk-in refrigeration units. These buildings are more likely to see a decrease. Effectively, in the old model they were given an average adjustment for refrigeration. But, in the new model they get a better adjustment given their conditions. If these schools *do* have walk-in units, their ratings will go up when that information is added.

- **Student Density:** No strong correlation is observed. This variable is not considered to be important it is no longer in the model.
- **Months in use:** Because of the way the old model was structured, buildings received an adjustment only if they were open for 12 months. This was not sensitive to the difference in the actual number of months (e.g. 9 month as compared with 11 month operation). Only about 25% of schools have 12 month operation. There is no significant trend observed with respect to months in use.

3. Revised Swimming Pool Methodology

Change: The engineered adjustments for the pool model have been updated. The new adjustments include a provision to account for whether the pool is located indoor or outdoor. The adjustments are based on standard assumptions to approximate heating and pumping requirements for the pool. These adjustments are designed for indoor pools. Outdoor pools are much more difficult to model, owing to specific exterior conditions, including the degree to which the pool is shaded. ***Because exterior pools are not within the building, EPA recommends that they be sub-metered and excluded from the Portfolio Manager analysis.*** When this is not possible, EPA will provide a very conservative adjustment for outdoor pools.

Impact to Ratings: Ratings for buildings with pools are likely to decrease. Evidence shows that buildings with pools were rating very high under the old methodology, averaging over 60 (greater than the average for buildings without pools). With the revised approach, the average is now closer to that of other buildings showing a more equitable method. The decrease may be more pronounced for pools located in cold climates.

4. Revised Eligibility Rules

Change: The purpose of these changes was to code into Portfolio Manager system rules that have ***always*** been intended and communicated in many ENERGY STAR documents, but up until now have been misapplied in the tool. There are two such rules

- **50% Rule – *More than* 50% of the building must be a *single* ratable space.** For example, a building that is 33% Office, 33% School, and 33% Retail cannot earn a rating.
- **Space Attribute Rule – The space attribute data provided must have an effective date that allows for 12 full months of data.** For example, a building cannot earn a rating if it has square foot and energy data starting on 1/1/08, but has 6/1/08 as the effective date for the number of workers. These types of inconsistencies arise due to misunderstanding of correct and update within PM. In preparation for this change the placement and language of these features were changed in August of 2008.

Impact to Ratings: If buildings do not meet the new rules, they will no longer have ratings.

- **50% Rule – Any building that currently has a rating but does not have a single space accounting for more than 50% of the floor area, will now have NA for a rating.**
- **Space Attribute Rule – Going forward, if a building makes a change that will cause it to break this rule, it will see NA (note that a warning message has been added to help prevent users from making this type of change inadvertently).** ***Existing buildings*** that do

not meet this rule will have their space attribute dates re-set so that they will still see a rating (for example, in the above situation the worker date will be reset to 1/1/08).

5. New Multifamily Housing Space

Change: A new space type will be added to track energy for multifamily housing facilities. The only required inputs will be energy and floor area, which will enable users to track energy, weather normalized energy, and emissions over time. In addition, some optional operating characteristics will be included for tracking purposes (please refer to the following section). ***At this time there are no available national average comparisons or ratings.***

Impact to Ratings: There will be no change to the ratings of any existing buildings. New Multifamily buildings will not be able to see ratings.

Changes to User Inputs

Due to model changes, there will be changes to user input requirements. These include the addition of some new operating characteristics and the removal of others. These changes are detailed below for each space type:

1. Hotel
 - a. New Inputs
 - i. Number of Workers
 - ii. Presence of Cooking (yes/no)
 - iii. Number of Commercial Refrigeration Units (includes walk-in, open, and closed units)
 - iv. Percent Heated
 - v. Percent Cooled
 - b. Removed Inputs
 - i. Hotel amenity category
2. K-12 School
 - a. New Inputs
 - i. High School (yes/no)
 - ii. Open Weekends (yes/no)
 - iii. Number of Walk-in Refrigeration Units
 - b. Removed Inputs
 - i. Student Seating Capacity
 - ii. Weekly Hours of Operation
 - iii. Mechanical Ventilation (yes/no)
 - c. Changed Input
 - i. Months in use is now optional; it is no longer required
3. Pool
 - a. New Input
 - i. Selection for whether the pool is indoor or outdoor.
 - b. Removed Inputs
 - i. Size (in square foot)

- ii. Size Option: Olympic (50 meters by 25 yards)
 - 1. Note that Olympic (50 meters by 25 meters) will remain as an option
- 4. Eligibility
 - a. New Input – In order to maintain a rating, users must understand the difference between correct and update. If they input a change in date using “correct”, and this change will cause them to have less than 12 months of space data, they will ***no longer*** be able to see a rating.
 - i. New alert messages have been created to warn users who are about to make this type of change.
- 5. Multifamily Housing
 - a. New Inputs – Required
 - i. Square foot
 - b. New Inputs – Optional
 - i. Total number of bedrooms
 - ii. Number of floors
 - iii. Percent of square footage devoted to individual units
 - iv. Laundry in each unit (yes/no)
 - v. Laundry in common area (yes/no)
 - vi. Dishwashers in each unit (yes/no)
 - vii. Percent Heated
 - viii. Percent Cooled
 - ix. Whether the Multifamily Housing space is Market Rate or Affordable Housing (drop-down menu options)

Attachment A –Filters for Analysis

Hotel Filters for Analysis		
Condition for Including a Record in the Analysis	Records Removed	Records Remaining
Building includes a Hotel	--	3358
Number of Primary Spaces = 1	73	3285
Room Density > 0.4 (SqFt/Room < 2500)	28	3257
Room Density < 5 (SqFt/Room > 200)	28	3229
EUI > 35	9	3220
EUI < 950	17	3203
All Initial Filters	155	3203

K-12 School Filters for Analysis		
Condition for Including a Record in the Analysis	Records Removed	Records Remaining
Building includes a School	--	18,738
Building Type = K-12 School	25	18,713
Number of Primary Spaces = 1	432	18,281
Seating Density > 1	76	18,205
Seating Density < 30	107	18,098
Number of Students < 10,000	51	18,047
EUI > 10	36	18,011
EUI < 1000	104	17,907
All Initial Filters	831	17,907